

(57) **Abstract:** A fiber optic cable trough cover system (100) has a cover (102) which can be attached and detached on either side of a trough (101) has two parts hinged together. The cover has a longitudinal hinge (103) which allows to the two parts to be pivoted about the hinge. Such a configuration provides a versatile access with limited overhead clearance.



*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**DESCRIPTION**  
**FIBER TROUGH COVER SYSTEM**

**Technical Field**

5           This invention pertains to a system for the management and routing of fiber optic cables, more particularly to a cover system for covering troughs and junctions while still providing access to the interior of the troughs and junctions, even where the clearance height above the troughs is limited.

10   **Background Art**

          In the telecommunications industry there are numerous locations where a significant amount of fiber optic cable must be routed within a facility or from one facility to another. The routing within a facility may be from one piece of equipment to another, or from outside lines coming into a central office and to fiber optic  
15 connectors where they are connected to equipment within the facility.

          The number of fibers may be great and the fibers must all be handled with great care to avoid damage to the fiber cable, which hinders its performance.

          In a typical facility, fiber optic troughs are normally used to carry or route the fiber optic cables. Although not necessarily, in most facilities the troughs are located  
20 overhead and over the location of the fiber optic distribution frames, bays and equipment.

          In certain types of facilities, a significant trough network is needed to contain and route the fiber cables. The installation time and expense can be substantial for said trough systems. The installation time and expense is further increased when the troughs,  
25 trough supports and junctions are not readily adaptable to the configuration desired in the facility and when the troughs, couplings, junctions, downfalls and other equipment do not readily or easily assemble, or when tools such as screwdrivers are required for installation. The typical prior art system requires numerous screws to secure the covers and other components together.

30           The design, layout and assembly of these trough systems are further complicated because of the unique nature of fiber cables and how the fiber cable must be placed, routed and managed. In the management of fiber optic cables, it is important to maintain a minimum bend radius to protect the fiber optic cables. One typical standard minimum bend radius is one and one-half inches, while another standard minimum bend  
35 radius is thirty millimeters (30mm).

It is also desirable to minimize the number and size of bumps, cracks, holes and other deviations from a smooth surface to which the fibers are exposed, or on which the fibers are supported.

For many years there has been an unsatisfied need to reduce the assembly time  
5 and/or expense by providing a trough system which minimizes or eliminates the need for the use of screws and other time consuming fasteners and holders, while still providing a trough system which protects the integrity of the fiber cables.

This invention provides a new trough system which reduces the assembly and installation time and expense of a trough system, and provides better access in low  
10 overhead clearance situations, for both troughs and for junctions.

In fiber optic trough systems, it is sometimes desirable to provide a cover for the interior of the trough system to prevent dust, parts, tools and other debris from falling into the interior of the fiber trough. It is also typically necessary to have reasonable access to the interior of the trough being covered, especially without having  
15 to relocate or move the cover system.

There are currently trough covers which snap on and off and must be taken off and temporarily located or stored elsewhere, while the fibers in the trough are being accessed. It becomes cumbersome to keep installing and removing the snap on type of covers and the covers are consequently removed and not replaced. The removed covers  
20 tend sit on the "cover pile" at certain installations and the customer therefore does not get the benefits of having a cover over the troughs.

In prior hinged systems, old hinge technology (metallic hinges) is utilized and the hinged side is normally attached by fasteners (typically screws) to one side of the trough and it spans the entire width of the trough. When the trough must be accessed,  
25 the entire cover (which spans the entire width of the trough) must be rotated upward. In the numerous installations in which there is very limited access, the hinge function of the cover cannot therefor be utilized in most cases because it doesn't sufficiently open to allow unhindered access due to the limited overhead clearance. Thus, in many applications, these covers likewise end up in the "trough cover pile".

30 A problem in providing covers for typical trough systems is that the trough systems are typically located overhead and there is very limited vertical distance or space above the trough.

While one embodiment of this invention provides a trough cover system for covering a trough element, another embodiment provides a junction cover system for  
35 covering a junction element, said junction cover system preferably including two hinges

for more desirable access. Both however allow better access in more limited clearance situations.

Providing a trough cover system is further compounded by the trough junctions because trough junctions typically have a greater span to cover, much greater than the width of the fiber cable troughs. In order to provide reasonable hinged access to junctions in the common limited overhead clearance scenario, a dual and/or split hinged cover is utilized.

#### **Brief Description of the Drawings**

10 Preferred embodiments of the invention are described below with reference to the accompanying drawings, which are briefly described below.

Figure 1 is a perspective view showing one embodiment of a trough cover system, including a trough and a cover;

15 Figure 2 is a perspective view showing one embodiment of a trough cover system, including a trough and a cover;

Figure 3 is an end view of one embodiment of a trough cover contemplated by this invention;

Figure 4 is a detail of a first side of the embodiment of the trough cover illustrated in Figure 3;

20 Figure 5 is a detail of a second side of the embodiment of the trough cover illustrated in Figure 3; and

Figure 6 is an end view of an embodiment of a trough contemplated by this invention and as shown in Figure 1.

#### **Best Modes for Carrying Out the Invention and Disclosure of Invention**

Many of the fastening, connection, manufacturing and other means and components utilized in this invention are widely known and used in the field of the invention described, and their exact nature or type is not necessary for an understanding and use of the invention by a person skilled in the art or science; therefore, they will not be discussed in significant detail. Furthermore, the various components shown or described herein for any specific application of this invention can be varied or altered as anticipated by this invention and the practice of a specific application or embodiment of any element may already be widely known or used in the art or by persons skilled in the art or science; therefore, each will not be discussed in significant detail.

35 The terms "a", "an", and "the" as used in the claims herein are used in conformance with long-standing claim drafting practice and not in a limiting way.

Unless specifically set forth herein, the terms "a", "an", and "the" are not limited to one of such elements, but instead mean "at least one".

The term latch is used herein in a broad sense, and covers numerous different mechanisms of attachment/detachment, including each component of a latch such as  
5 corresponding and complementary components which interact with one another. The term latch as used herein is in no way to be limited to the configuration(s) shown in the drawings or described herein. The term latch as used herein, by way of example but not limitation, would therefore include structures which fasten or retain, such as a flexible member with a detent or a tab contained thereon, which would then interact  
10 with a corresponding and complementary component (also referred to as a latch), which may be a detent or a tab. Latch is intended to cover each of the configurations or structures that attach or fasten to one another in a complementary way, or would for example allow a component to attach to the side wall of the trough. Further the term latch is intended to cover each of the two complementary components which interact or  
15 complement each other.

Figure 1 is a perspective view showing one embodiment of a trough cover system 100 contemplated by this invention. Figure 1 shows a fiber optic cable trough 101, with a trough bottom wall 101a, a first side wall 101b and a second side wall 101c. The trough 101 is preferably (but need not be) extruded and may be a plastic,  
20 preferably an ABS plastic.

The trough cover 102 includes a first side 102a and a second side 102b. Hinge 103 is shown preferably offset and not centered.

Figure 1 further illustrates one of numerous alternatives for a latch 105 at the first side 102a of the cover 102 and at a second side 102b of the cover 102. The  
25 preferred latch is shown in more detail in other figures.

The term latch and complementary latch as used herein includes any complementary set of structures which secure to one another, such as that shown and numerous other possible latch configurations and structures which are or may become known in the trade. Figure 1 shows a latch 102d extruded into the cover 102 and with  
30 a hook-like configuration which complements and interlocks with the latch 105 extruded into both side walls of the trough 101. The latch 105 includes an upper latch member and a lower latch member with detents thereon which are complementary to detents on the latches on the first side 102a and second side 102b of the trough cover 102.

Figure 2 is a perspective view showing one embodiment of a trough cover  
35 system, including a trough and a cover, and illustrates the second side 102b of the

trough cover 102 rotated open to allow access into the interior of the trough 101. Like numbered items are the same as in Figure 1 and will not be repeated here.

Figure 3 is an end view of one embodiment of a trough cover contemplated by this invention, and shows the trough cover 102. The first side 102a includes a latch  
5 102d which is shown more fully in Figure 4, and the second side 102b includes latch 102e which is shown more fully in Figure 5. Figure 3 also illustrates the hinge 103 in the cover 102.

Figure 4 is a detail of the latch 102d at or near the first side 102a of the trough illustrated in Figure 3. Figure 4 shows one embodiment of a latch, including a tab to  
10 interact with and complement a corresponding latch and a detent in the applicable trough side wall.

Figure 5 is a detail of the latch 102e of the second side 102b of the embodiment of the trough cover illustrated in Figure 3. Figure 5 illustrates tab 112 and detent 110  
15 which latch or interact with the corresponding or complementary latch on the trough side wall.

Figure 6 is an end view of an embodiment of a trough contemplated by this invention and as shown in Figure 1. Figure 6 illustrates trough 101 with bottom wall 101a, first side wall 101b and second side wall 101c. Rails 115 are on the outside of the trough 101. Figure 6 further illustrates one example of a latch which corresponds  
20 to and complement the latches 102d and 102e in the trough cover 102. In this embodiment, latches 120 include latch aperture 122, tab 121 and detent 123.

As will be appreciated by those of reasonable skill in the art, there are numerous embodiments to this invention, and variations of elements and components which may be used, all within the scope of this invention.

25 One embodiment of this invention for example is a trough cover for a fiber optic cable trough, the cover comprising a longitudinal cover body with a first side and a second side, the first side and the second side each being adapted to releasably attach to the top of a respective first side wall and second side wall of a fiber optic cable trough; a longitudinally oriented hinge in the cover body, the hinge being located  
30 between the first side and the second side of the cover body; such that the first side of the cover body may be pivotable about the hinge when detached from the top of the first side wall of the trough; and the second side of the cover body may pivotable about the hinge when detached from the top of the second side wall of the trough.

The cover body could be provided with the same latch on both sides of the  
35 cover body, such as both provided with the latch shown on the second side 102b of the cover body. This would allow either side of the cover to be attached and separately

pivoted while still being securely attached to the trough latch. It should also be noted that even if the configuration shown in the figures is practiced, the cover may be mounted in either direction to best utilized the direction of the pivot.

A further embodiment is one in which hinge referred to above is one piece with  
5 the cover, i.e. the cover with the hinge is one piece. This may, but is not limited to being accomplished for example by co-extruding ABS plastic on the sides with a flexible urethane or a flexible vinyl as the hinge. While it is preferable that the material or composition utilized for the hinge be different than for the respective first side and second side of the cover body, it is not necessary depending on the material  
10 selected. For example, extruding a different or thinner geometry in the cover could create a longitudinally oriented hinge in the cover body.

An embodiment and advantage of this invention is that the first side and/or the second side of the cover body may be adapted to be attached to the top of the side walls of the trough without the use of a tool. In prior art systems, numerous screws  
15 and a screwdriver are required to install and uninstall the cover bodies. With the hinge longitudinally between the first side and the second side of the cover body, and with each side being attachable and detachable from the tops of the side walls of the trough, embodiments of this invention allow either side of the cover body to be pivoted about the axis of the hinge for access to the interior of the trough. This allows either side  
20 of the cover body to be pivoted upward and over on to the other side, providing versatile and unprecedented access to the interior of the trough.

The first side and/or the second side of the trough cover may be provided with a latch to attach it to the top of a side wall of the trough.

In another embodiment of this invention, a trough cover includes a longitudinal  
25 cover body with a first side and a second side, with the distance between the first side and the second side defining a trough cover width. In this embodiment, a longitudinally oriented hinge in the cover body is disposed to allow either the first side or the second side of the cover body to be pivoted about the hinge such that the distance from the pivoted side to the hinge is less than the cover width.

30 This allows access to the interior of a trough to be accessed even though there is not a clearance distance above the top of the trough so that the entire cover width can be pivoted and moved aside to allow access to the interior of the trough.

In yet another embodiment of a trough cover contemplated by this invention, the cover is comprised of: a longitudinal cover body with a first side and a second side;  
35 and a longitudinally oriented hinge between the first side and the second side of the



cover body, the hinge disposed to allow either the first side or the second side of the cover body to pivot about the hinge and thereby be placed on the other.

This allows one side of the cover body to be attached and detached to the top of a side wall of the trough, and placed on the other side wall while the interior of the  
5 trough is being accessed. This further allows the operator to choose which side is desired. The hinge need not be centered between the first side and the second side of the cover, so that the operator may further choose which side to pivot depending on the nature of the access desired as well as the amount of clearance above the trough.

This invention includes a process for making a trough cover for a fiber optic  
10 cable trough, comprising the steps of: providing a molten plastic material for extruding a first side and a second side of a trough cover body; providing a molten hinge material of greater flexibility than the plastic material, between the first side and the second side, for co-extruding with the plastic material; co-extruding the hinge material between a first side and a second side of molten plastic material; and thereby forming a one-piece  
15 trough cover body which includes a longitudinal hinge where the hinge material was co-extruded therein.

Although embodiments of this invention may be made by any process, some embodiments use a co-extrusion process. The co-extrusion process uses a two head extruder with one barrel perpendicular to the other. The materials are extruded  
20 simultaneously and run through the extrusion die at the same time. The die is designed to joining the two materials either mechanically or chemically or with pressure and heat. The mechanical bond uses the shape of the extrusion to join the parts together like a tongue and groove or similar joint design. The chemical bond of a co-extruded product uses two types of material that join as they are extruded, which are typically (but need  
25 not be) the same or similar material. The chemical bonding is the preferred process used in an embodiment of this invention, where the materials are similar but not the same. In an embodiment of this invention the two materials (a V-0 ABS and a V-0 Urethane) are bonded together by the extrusion process itself. The materials are extruded from both barrels at the same time and forced into the die at the precise  
30 location of the hinge. The use of heat and the pressure from the extrusion process force the two materials to bond. The materials are then pulled through sizers to get to the required or desired shape. There may be one or more sizers used to create the shape shown in the drawings. The extruded covers may then be cut to the desired lengths.

35 Another further embodiment of a process contemplated by this invention, includes contemporaneously extruding a latch on the first side of the cover body and on the

second side of the cover body. The latch would correspond with a complementary latch on the top of one or both of the side walls of the trough, with the latches being adapted to be attached and detached to the corresponding and complementary latch on the fiber optic cable trough.

- 5           A preferred embodiment also contemplates extruding a fiber optic cable trough with a first trough latch near a top of a first side wall and a second trough latch near a top of a second side wall, the first and second trough latches being adapted to be attached and detached to a corresponding latch on the trough cover body. Sample latches are shown in the figures and described more fully above in relation to the
- 10   figures.

CLAIMS

I claim:

1. A trough cover for a fiber optic cable trough, the cover comprising:
  - (a) a longitudinal cover body with a first side and a second side, the first side and  
5 the second side each being adapted to releasably attach to the top of a respective  
first side wall and second side wall of a fiber optic cable trough;
  - (b) a longitudinally oriented hinge in the cover body, the hinge being located  
between the first side and the second side of the cover body;such that the first side of the cover body is pivotable about the hinge when detached  
10 from the top of the first side wall of the trough.
2. A trough cover as recited in claim 1, and further wherein the second side of the  
cover body is pivotable about the hinge when detached from the top of the second side  
wall of the trough  
15
3. A trough cover as recited in claim 1, and wherein the hinge is one piece with  
the cover.
4. A trough cover as recited in claim 2, and further wherein the hinge is composed  
20 of a material different than the first side and the second side of the cover body.
5. A trough cover as recited in claim 1, and further wherein the hinge is co-  
extruded into the cover body.
- 25 6. A trough cover as recited in claim 1, and wherein the first side and the second  
side of the cover body are each adapted to be attached to the trough without the use  
of a tool.
7. A trough cover as recited in claim 1, and wherein the first side or the second  
30 side of the cover body has a latch which attaches a respective side to a corresponding  
latch on the top of the first side wall of the trough or to the top of the second side  
wall of the trough.
8. A trough cover as recited in claim 1, and wherein the first side of the cover  
35 body has a latch which attaches to a corresponding latch on the top of the first side

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wall of the trough, and the second side of the cover body has a latch which attaches to a corresponding latch on the top of the second side wall of the trough.

9. A trough cover as recited in claim 1, and wherein the first side and the second  
5 side of the cover body are composed of plastic.

10. A trough cover as recited in claim 9, and wherein the hinge is composed of urethane.

10 11. A trough cover for a fiber optic cable trough adapted to attach to a fiber optic cable trough, the cover comprising:

- (a) a longitudinal cover body with a first side and a second side, with a cover width between the first side and the second side; and
- (b) a longitudinally oriented hinge in the cover body, the hinge disposed to allow  
15 a pivoted side of either the first side or the second side of the cover body, to pivot about the hinge;

such that the distance from the pivoted side to the hinge is less than the cover width.

12. A trough cover for a fiber optic cable trough adapted to attach to a fiber optic  
20 cable trough, the cover comprising:

- (a) a longitudinal cover body with a first side and a second side; and
- (b) a longitudinally oriented hinge between the first side and the second side of the cover body, the hinge disposed to allow either the first side or the second side of the cover body to pivot about the hinge and thereby be placed on the other.

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13. A covered fiber optic cable trough system comprising:

- (a) an elongated fiber optic cable trough, including a trough bottom wall, a trough first side wall and a trough second side wall, the first side wall including a  
30 latch on or near its top, and the second side wall including a latch on or near its top;

- (b) a trough cover for a fiber optic cable trough, the cover comprising:
  - (i) a longitudinal cover body with a first side and a second side, the first side and the second side each including a complementary latch  
35 corresponding to the respective first side wall or second side wall of the trough and which is adapted to releasably attach to the top of the

respective first side wall or second side wall of the fiber optic cable trough;

- (ii) a longitudinally oriented hinge in the cover body, the hinge being located between the first side and the second side of the cover body;

5 such that the first side of the cover body is pivotable about the hinge when detached from the top of the first side wall of the trough; and the second side of the cover body is pivotable about the hinge when detached from the top of the second side wall of the trough.

10

14. A process for making a trough cover for a fiber optic cable trough, comprising the following steps:

- (a) providing a molten plastic material for extruding a first side and a second side of a trough cover body;
- 15 (b) providing a molten hinge material of greater flexibility than the plastic material, between the first side and the second side, for co-extruding with the plastic material;
- (c) co-extruding the hinge material between a first side and a second side of molten plastic material;
- 20 thereby forming a one-piece trough cover body which includes a longitudinal hinge where the hinge material was co-extruded therein.

15. A process for making a trough cover as recited in claim 14, and further comprising the following steps:

- 25 (a) contemporaneously extruding a latch on the first side of the cover body and on the second side of the cover body, adapted to be attached and detached to a corresponding latch on the fiber optic cable trough.

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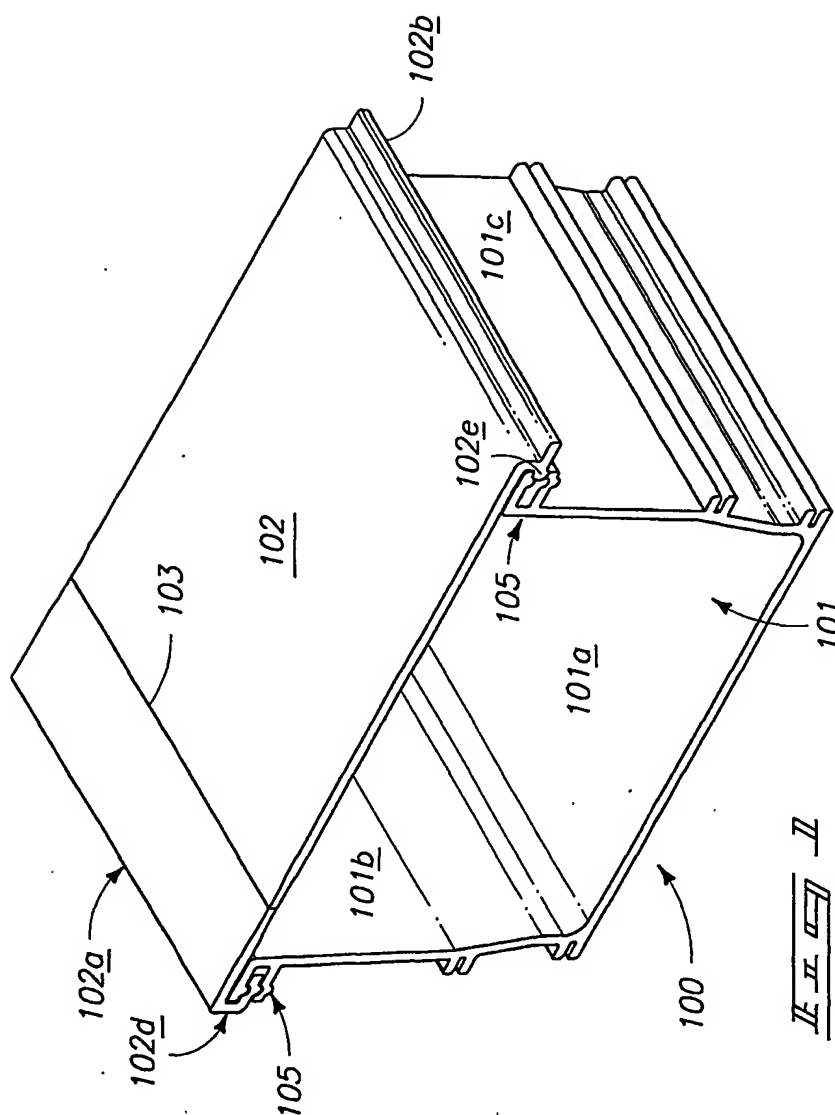
16. A process for making a fiber optic cable trough cover system comprising the following steps:

- (a) providing a molten plastic material for extruding a first side and a second side of a trough cover body;

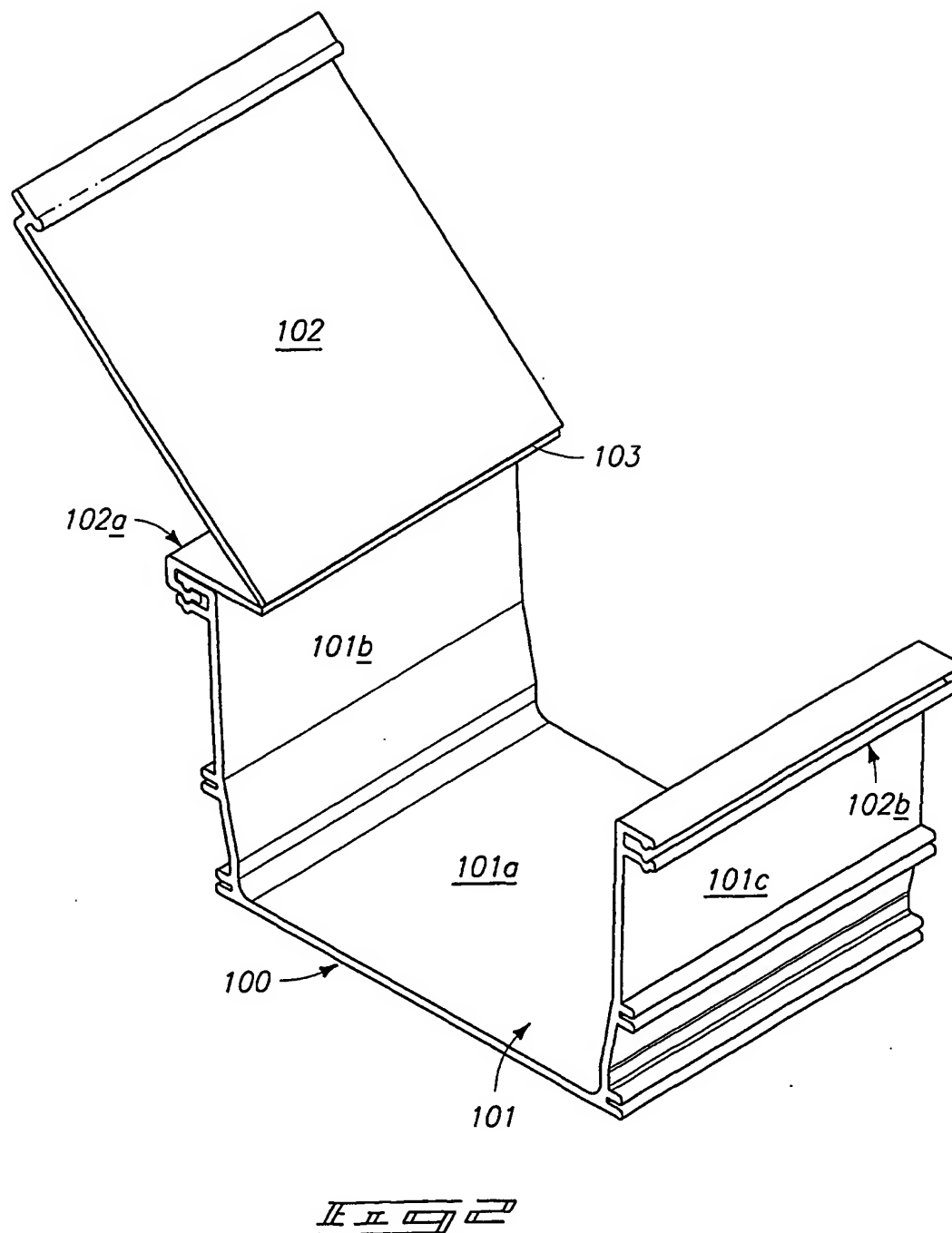
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- (b) providing a molten hinge material of greater flexibility than the plastic material, between the first side and the second side, for co-extruding with the plastic material;
- (c) co-extruding the hinge material between a first side and a second side of molten plastic material, contemporaneously extruding a latch on the first side of the cover body and on the second side of the cover body; thereby forming a one-piece trough cover body which includes a longitudinal hinge where the hinge material was co-extruded therein; and
- (d) extruding a fiber optic cable trough with a first trough latch near a top of a first side wall and a second trough latch near a top of a second side wall, the first and second trough latches being adapted to be attached and detached to a corresponding latch on the trough cover body.

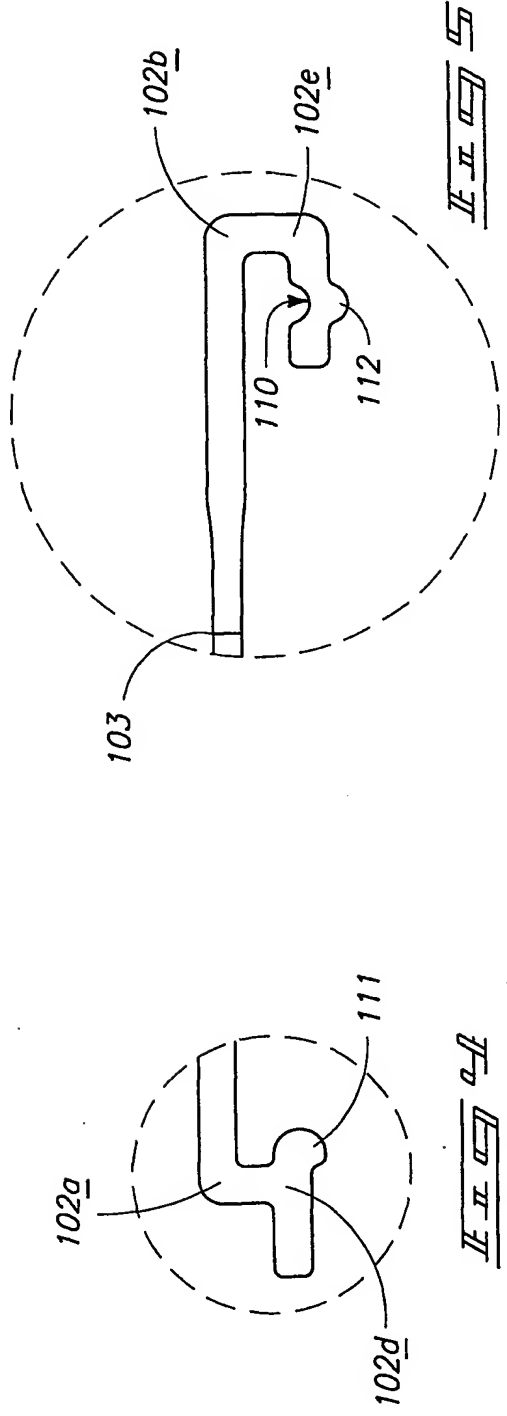
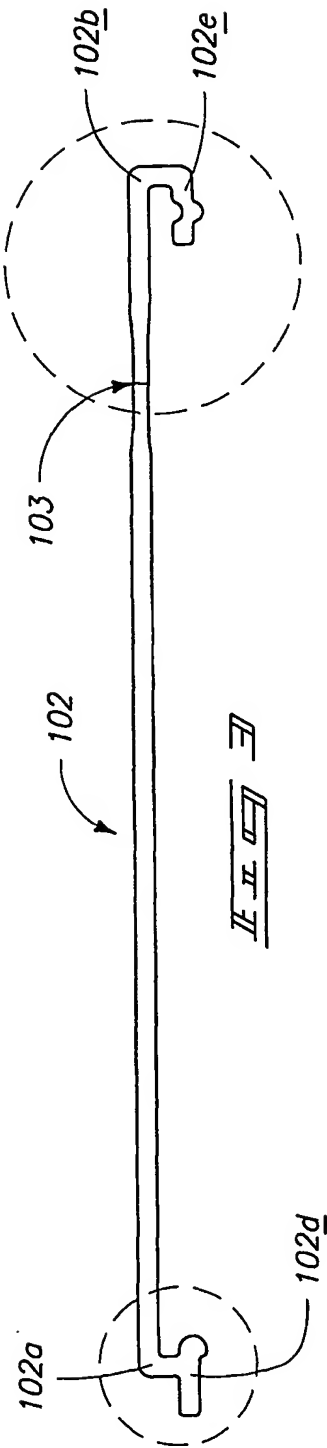
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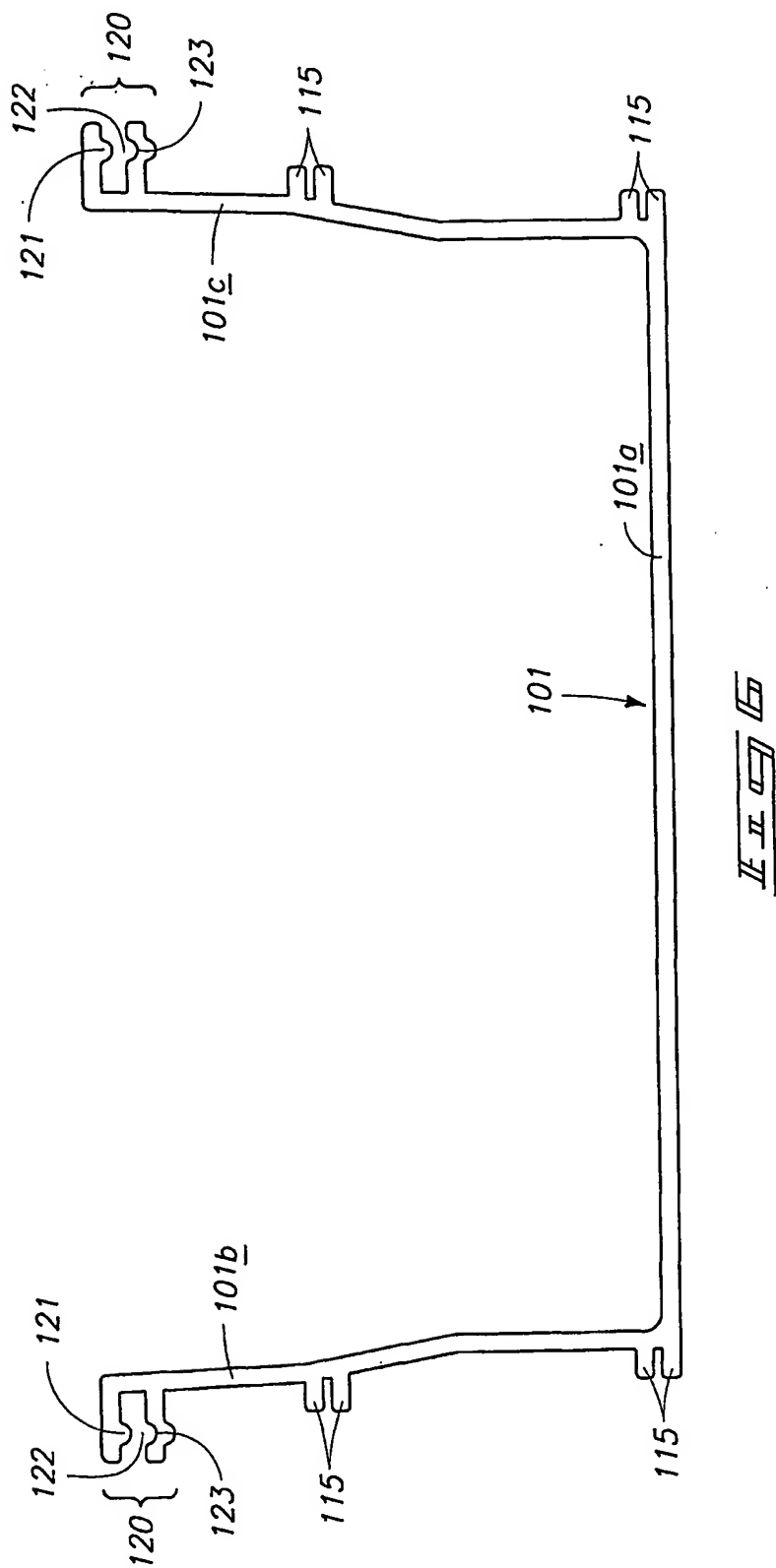
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# INTERNATIONAL SEARCH REPORT

International application No.

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## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G02B 6/36

US CL : 385/134

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 385/134

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
<input checked="" type="checkbox"/>	US 5, 064,088 A (Steffes) 12 November 1991 (12.11.1991), Fig. 1-14	1-12, 14-16
<input checked="" type="checkbox"/>	US 5,734,776 A (Puetz) 31 March 1998 (31.03.1998), Fig. 1-4	13

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

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